Pollution Prevention at Los Alamos National Laboratory

Green is Clean

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The Challenge

The Laboratory generates approximately 400 m^3 of routine Low Level Waste (LLW) and 500 to 1000 m^3 of non-routine LLW annually. It is estimated that as much as half of this waste is not radiologically contaminated. For the past several years, the Laboratory has been trying to implement a Green is Clean (GIC) program. The GIC program consists of waste segregation activities based on Acceptable Knowledge (AK) within Radiological Control Areas (RCAs). Waste, for which AK exists that the waste is not contaminated, is segregated from other waste generated within the RCA and labeled as GIC waste. After generation, the waste is shipped to FWO-SWO for verification that it is not radiologically contaminated. After verification, the waste is disposed of as sanitary waste.

The Laboratory only generated 17 m^3 of GIC waste in FY-01. An Appendix F performance measure requires the Laboratory to adopt GIC as a best practice and complete implementation. It is estimated that at full implementation, several hundred cubic meters of GIC waste could be generated annually, significantly reducing the LLW stream. The Environmental Stewardship Office (ESO) has challenged the Laboratory to fully implement GIC in FY-02. The Laboratory has responded to this challenge by agreeing to apply the Green Zia systems approach to address this problem.

This paper will discuss how the Laboratory team used the following tools to address the issues involved with full implementation of GIC.

- Determining opportunities in the current process using process maps
- Rank ordering of the opportunities to improve the process using a Pareto analysis and activity based costing.
- Determining the root cause of the selected opportunity using a cause and effect (fishbone) diagram.
- Posing a consensus problem statement for generating process alternatives.
- Generating process alternatives.
- Selecting alternatives using a forced pairs comparison.
- Implementing the selected alternatives with a formal action plan.

Green is Clean Team

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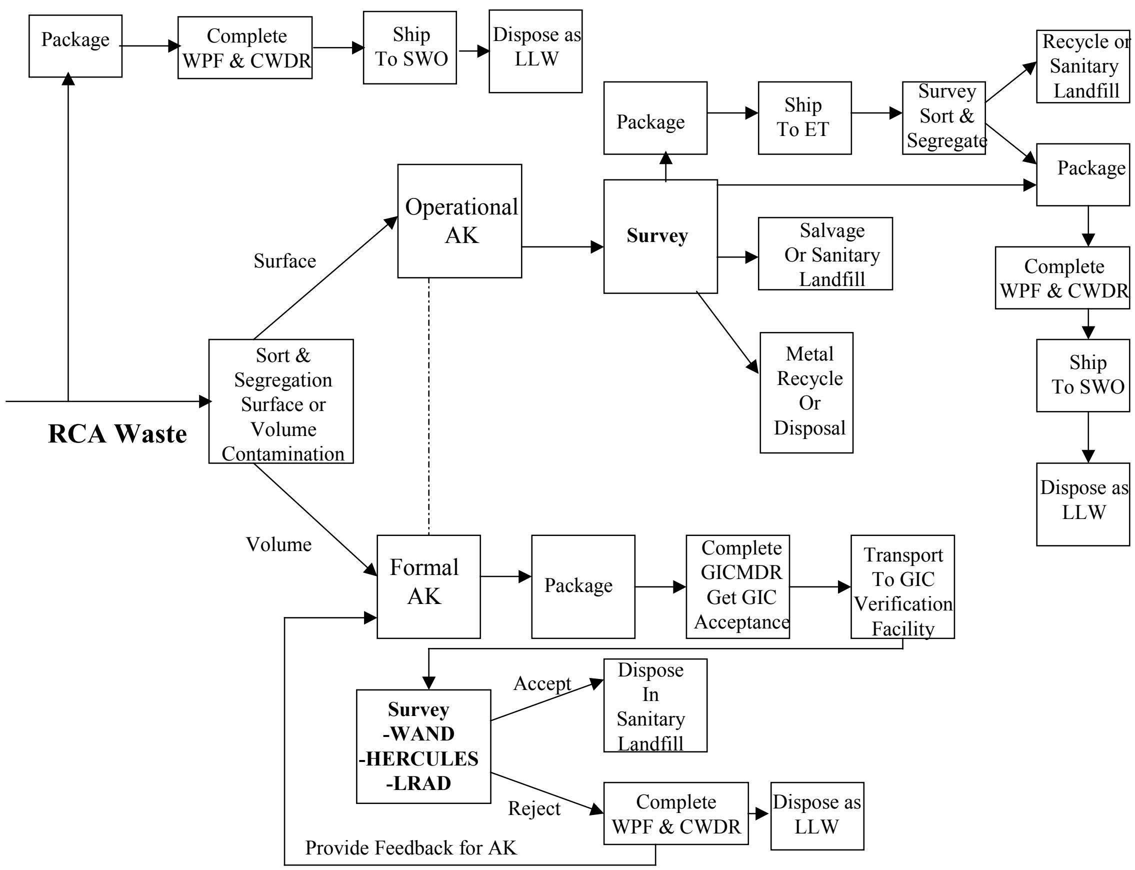
Process Mapping

The team prepared a process map for the generation and disposal of waste from RCAs (see Figure 1)

Figure 1



RCA wastes are either disposed of as LLW or processed for survey and evaluated for other disposal/recycling pathways. Volume contaminated waste is segregated based on a formal AK plan and packaged for shipment to the GIC verification facility. A GIC Material Disposal Request (GICMDR) form is completed and then approved by the GIC program. After approval, the waste is shipped to the GIC verification facility, surveyed, and disposed. A Waste Profile Form (WPF) and Chemical Waste Disposal Request (CWDR) are completed for waste rejected by the survey process and that waste is disposed of as LLW. Feedback is provided to the generator's to improve their AK. Waste accepted by the process is disposed of as sanitary waste to the Los Alamos County Landfill.

Surface contaminated wastes are evaluated by waste generators based on operational AK. A radiological survey is performed by Radiological Control Technicians (RCTs) and the material is either packaged for disposal as LLW, shipped to the Environmental Technology (ET) group for further assay, sent to salvage or the landfill, or recycled as scrap metal. It should be noted that the recycling of scrap metal is currently under suspension by DOE; however, metal can be sent to disposal at an industrial landfill. Equipment shipped to ET that has been identified as containing less than 2 nCi/g as does not require shipment as radioactive waste. Once received at ET, the equipment is disassembled, surveyed, sorted and segregated. Releasable materials are recycled or disposed of as sanitary waste. Non-releasable materials are packaged, a WPF and CWDR are prepared, and the material is shipped to SWO for disposal as LLW. On a case by case basis, dependant on operational AK, some materials are transferred to the GIC verification facility for evaluation and verification.

Rank Ordering of Opportunities

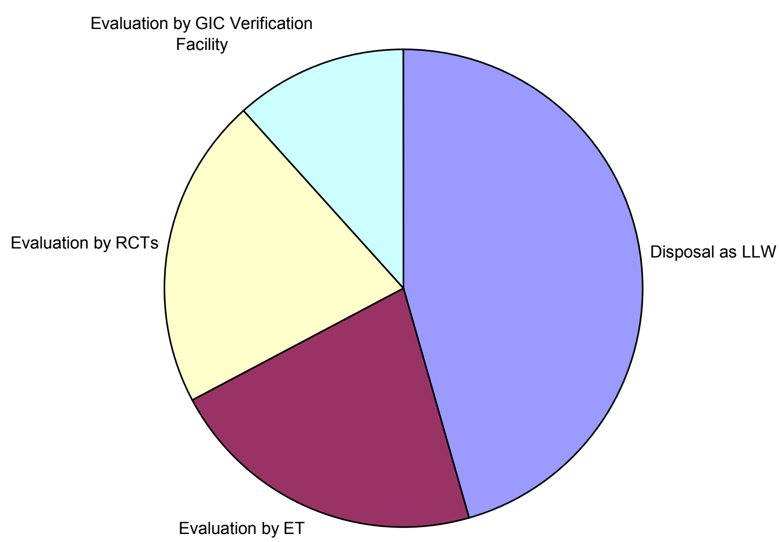
Four distinct pathways for RCA wastes are depicted on the process map. Disposal as LLW, survey and salvage, recycling, or disposal as sanitary waste, shipment to ET for further evaluation, shipment to the GIC verification facility.

Table 1

Activity	Cost (per m^3)
LLW Disposal	
Packaging	$250.00
Characterization, WPF,CWDR	$400.00
Shipment	$200.00
Disposal	$2486.00
Total	**$3336.00**
RCT Survey and Recycle/Disposal	
Radiological Survey	$1500.00
Recycle/Disposal/Salvage	$50.00
Total	**$1550.00**
ET Evaluation	
Shipment to ET	$50.00
ET Evaluation	$1500.00
Recycle/Disposal	$50.00
Total	**$1600.00**
GIC Verification Facility	
Shipment to GIC Facility	$50.00
GIC Verification Survey	$750.00
Disposal	$50.00
Total	**$850.00**

Based on operational experience, the team estimated the costs associated with these pathways. These estimates are summarized in Table 1. The costs summarized in Table 1 indicate that disposal as LLW costs \$3,386 per cubic meter, evaluation by ET about \$1,700 per cubic meter, evaluation by RCTs about \$1550 per cubic meter, and evaluation by the GIC verification facility about \$850 per cubic meter. Table 1 provides a breakdown of these costs and the costs are depicted in Figure 2.Figure 2 clearly illustrates that disposal of RCA waste as LLW is the most expensive alternative. Therefore, minimizing LLW generation and enhancing the amount of GIC waste processed represents the best alternative. This Green Zia analysis will concentrate on alternatives to enhance the amount of GIC waste processed.

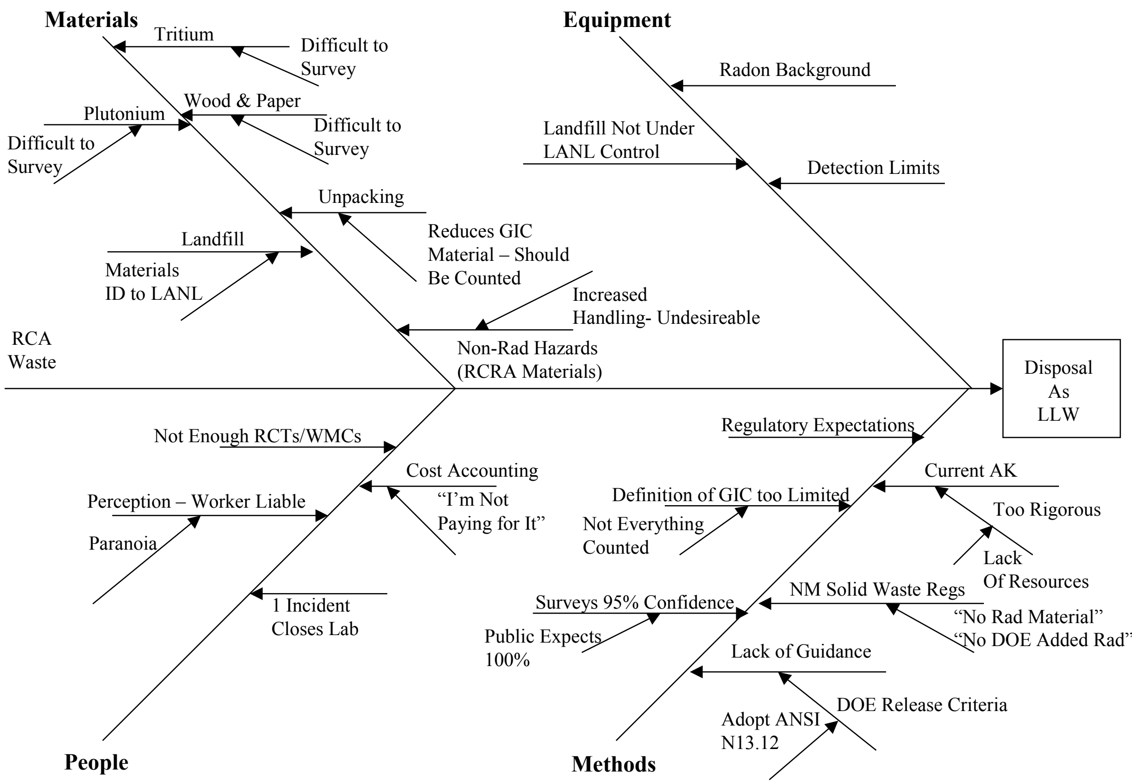
Figure 2



Root Cause Analysis and Statement of Problem

The team examined issues associated with LLW generation with a cause and effect diagram to identify potential causes of the problem. The diagram is depicted in Figure 3.

Figure 3



The following is a detailed list and description of the items present on the cause and effect diagram.

- Plutonium and Tritium are difficult to survey: Alpha and low energy beta emitters present at Los Alamos makes it very difficult to survey the waste. Surveys are even more complicated when the waste is made up of porous materials such as wood or paper. Radon background is difficult to eliminate. The detection capabilities of instrumentation need to be improved by eliminating radon background affects and/or by subtracting background readings from the result. This is especially difficult for samples contaminated with soil containing several background radioisotopes when the amount of soil contamination is difficult to determine.
- Many materials disposed of by the Laboratory can be easily identified as coming from the Laboratory. This increases the potential that these materials will be checked by the public looking for radiological levels above background.
- The Definition of GIC is too limited: Equipment and others materials are unpacked before they enter a RCA. The packing material should be counted as part of the GIC program. LANSCE surveys all of their dumpster waste prior to release for sanitary waste disposal. This waste should be counted as part of the

GIC program. Use of launderables and other waste minimization efforts should be counted as part of GIC program.

- Not enough RCTs and Waste Management Coordinators (WMCs): More RCTs and WMCs are required to performed the additional survey and sorting and segregation activities necessary to increase GIC waste.
- Cost Accounting ‘I’m not paying for it”: In many cases, the generator does not see the full cost of LLW generation. Waste management costs are born by the program office. WMC and RCT support are born by waste management organizations or the program office.
- NM Solid Waste Regulations: The NM solid waste regulations specify no radiological material. The Laboratory has adopted a “No DOE added Rad” policy. These regulations and policies are too vague. Absolute compliance with either is impossible. A policy defining reasonable expectations needs to be developed. The public expects a 100% confidence level which is impossible to achieve with surface surveys because a certain amount of the survey area is almost always inaccessible to the survey instrumentation. A 95% confidence level is practicable but does not positively ensure the above criteria are met. DOE guidance is either lacking or is not applicable because it requires acceptance by the State of NM. A nationally accepted release criteria such as defined in ANSI N13.12 would eliminate many of these problems.
- Current AK requirements are too rigorous: The Savannah River Site (SRS) relies heavily on RCT surveys of RCAs to determine if RCA waste is a candidate for GIC. The Laboratory relies on worker knowledge that the waste material did not contact radiological materials. This criterion does not rely on survey data but requires good control and knowledge of the process. Integration of survey data into the AK process would make the development of AK easier.
- Workers feel Liable: Any incidence involving the detection of radiological contamination on material released from the Laboratory will result in extensive media coverage. Such an incidence would likely cause a partial shutdown of Laboratory operations resulting in lost productivity and the costs associated with this loss of productivity. Release of material representing a public health hazard is extremely unlikely. Such an incident would be caused by the release of material with “detectable” activity levels. Workers are concerned that if the released material can be traced to them, that their performance appraisals and possible jobs may be in jeopardy.
- Landfill not under LANL control: The sanitary waste landfill is not under LANL control. This means that the public has access to LANL waste and increases the probability that waste with detectable radiological levels could be discovered.

Team members were requested to review the results of the root cause analysis and prepare a statement that captured what each person though were the major issues involved in the disposal of GIC wastes as LLW. The following consensus statement of the problem was prepared.

A significant amount of Green is Clean (uncontaminated) wastes are being disposed of as Low Level Wastes. Disposal as LLW increases operating costs and uses valuable LLW landfill space. There are a least three causes that contribute to this situtation:

- *Lack of release criteria that have public acceptance and that can be reasonably monitored*
- *Public access to sanitary landfills and the easy identification of LANL wastes*
- *Worker perception that any incident involving the release of wastes will be considered their and not the institution or DOE responsibility.*

Generating Process Alternatives

A brain storming tool was used by the team to generate possible alternatives to the problem. The alternatives that resulted from this activity are as follows:

1. Limit public access to sanitary waste by creating an onsite landfill.
2. Expand the current Green is Clean operations to include the release of potentially surface contaminated materials and to eliminate the responsibility of release from current operational organizations.
3. Destroy the waste forms prior to disposal to ensure that disposal of materials cannot be connected to Laboratory operations.
4. Adopt ANSI N13.12 limits and get DOE and NMED concurrence.
5. Redefine AK, evaluate and train to facility specific procedures.
6. Dispose of GIC wastes at Rio Rancho to eliminate public access.
7. Issue a no-fault Laboratory policy that specifies worker responsibilities.
8. Perform a cost/risk/benefit analysis of GIC to determine if the risk associated with GIC justifies the process.
9. Offer economic incentives to generators that result in real waste reduction savings.
10. Use reusable materials to eliminate the need for GIC.
11. Better define what materials are acceptable GIC candidates.
12. Engage DOE as a full partner in the process. Ensure that DOE is willing to share responsibility with the Laboratory and that incidents resulting from reasonable implementation of GIC will not affect DOE's assessment of Laboratory performance.
13. Implement an awards program that specifically encourages and rewards participation in GIC.
14. Grind, shred, or in some other way homogenize all GIC waste so that representative samples could be taken and the Laboratory could adopt a 100% verification of all GIC waste.
15. Determine if AK derived from RCT surveys is adequate for segregation of GIC waste. Perform a pilot on hob job wastes, etc..
16. Develop division performance metrics to measure and encourage GIC participation.

17. Redefine definition of GIC wastes to ensure that the Laboratory receives credit for other waste minimization practices (segregation of packing materials, use of launderables, etc.) as part of the overall GIC effort.

Selecting an Alternative

The team used a forced pair comparison to select alternatives that should be implemented in the near term. The ease of implementation, likelihood of success, and overall impact were all considered when prioritizing alternatives. For ease, many of the alternatives in the previous section were combined. The alternatives that resulted from this activity are as follows:

1. Reduce the "Perceived" Risk associated with sanitary waste landfill disposal of GIC wastes. Evaluate alternatives for homogenizing, destroying the identity, and isolating the public from GIC wastes.
2. Redefine AK for GIC wastes. Perform a pilot using RCT surveys as AK. Based on the results of the pilot, redefine AK criteria. Perform a risk based cost/benefit analysis to justify new AK approach.
3. Better define GIC candidates and ensure full credit for other waste minimization programs. Include use of reusable materials and procedures that require the unpacking of materials prior to their introduction to a RCA. Include metal released for recycling or disposal.
4. Develop a no-fault Lab policy for GIC waste and engage DOE as a full partner in this policy.
5. Evaluate a 100% verification strategy.
6. Develop GIC performance metrics and implement a GIC award/incentive program. Better tie LLW disposal costs to waste generators if possible.

Action Plan

The following action plan was prepared by the team to implement the alternatives.

Action Item	Organization	Due Date	Comments
Reduce the "Perceived" Risk	E-ESO, FWO-SWO	5/1/02	Operational Cost Driver
Perform Pilot using AK derived from RCT surveys	NMT-7, ESH-1, NMT-OPS	6/1/02	
Redefine AK	E-ESO, ESH-12, FWO-SWO	7/1/02	Requires Pilot Data
Redefine GIC Wastes	E-ESO	6/1/02	
Develop No-Fault Lab Policy	ESH-12/DOE	7/1/02	Requires completion of first 3 items
Develop GIC Metrics and Incentives	E-ESO	6/1/02	